

**U.S. FISH AND WILDLIFE SERVICE  
SPECIES ASSESSMENT AND LISTING PRIORITY ASSIGNMENT FORM**

SCIENTIFIC NAME: *Bidens conjuncta*

COMMON NAME: Ko'oko'olau

LEAD REGION: Region 1

INFORMATION CURRENT AS OF: July 2005

**STATUS/ACTION:**

☐ Species assessment - determined species did not meet the definition of endangered or threatened under the Act and, therefore, was not elevated to Candidate status

☐ New candidate

☒ Continuing candidate

☐ Non-petitioned

☒ Petitioned - Date petition received: May 11, 2004

☐ 90-day positive - FR date:

☒ 12-month warranted but precluded - FR date: May 11, 2005

☐ Did the petition request a reclassification of a listed species?

**FOR PETITIONED CANDIDATE SPECIES:**

a. Is listing warranted (if yes, see summary of threats below)? yes

b. To date, has publication of a proposal to list been precluded by other higher priority listing actions? yes

c. If the answer to a. and b. is "yes", provide an explanation of why the action is precluded. We find that the immediate issuance of a proposed rule and timely promulgation of a final rule for this species has been, for the preceding 12 months, and continues to be, precluded by higher priority listing actions. During the past 12 months, most of our national listing budget has been consumed by work on various listing actions to comply with court orders and court-approved settlement agreements, meeting statutory deadlines for petition findings or listing determinations, emergency listing evaluations and determinations and essential litigation-related, administrative, and program management tasks. We will continue to monitor the status of this species as new information becomes available. This review will determine if a change in status is warranted, including the need to make prompt use of emergency listing procedures. For information on listing actions taken over the past 12 months, see the discussion of "Progress on Revising the Lists," in the current CNOR which can be viewed on our Internet website (<http://endangered.fws.gov>).

☐ Listing priority change

Former LP: ☐

New LP: ☐

Date when the species first became a Candidate (as currently defined): 1999

☐ Candidate removal: Former LP: ☐

☐ A – Taxon is more abundant or widespread than previously believed or not subject to

the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status.

- \_\_\_ U – Taxon not subject to the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status due, in part or totally, to conservation efforts that remove or reduce the threats to the species.
- \_\_\_ F – Range is no longer a U.S. territory.
- \_\_\_ I – Insufficient information exists on biological vulnerability and threats to support listing.
- \_\_\_ M – Taxon mistakenly included in past notice of review.
- \_\_\_ N – Taxon does not meet the Act’s definition of “species.”
- \_\_\_ X – Taxon believed to be extinct.

ANIMAL/PLANT GROUP AND FAMILY: Flowering plants, Asteraceae (Sunflower family)

HISTORICAL STATES/TERRITORIES/COUNTRIES OF OCCURRENCE: Hawaii, island of Maui

CURRENT STATES/ COUNTIES/TERRITORIES/COUNTRIES OF OCCURRENCE: Hawaii, island of Maui

LAND OWNERSHIP: Populations occur on State of Hawaii and privately owned land.

LEAD REGION CONTACT: Paul Phifer, 503-872-2823, paul\_phifer@fws.gov

LEAD FIELD OFFICE CONTACT: Pacific Islands Fish and Wildlife Office, Christa Russell, 808-792-9400, christa\_russell@fws.gov

#### BIOLOGICAL INFORMATION:

Species Description *Bidens conjuncta* is an erect, perennial herb, 0.7 to 2 meters (m) (2.3 to 6.6 feet (ft)) tall, with horizontal or ascending lateral branches. The leaves are simple or pinnately compound, 6 to 15 centimeters (cm) (2.4 to 6 inches (in)) long, comprised of 1 to 5 leaflets which are ovate-lanceolate, 5.5 to 10.5 cm (2.2 to 4.0 in) long, 3 to 6 cm (1.2 to 2.4 in) wide, densely pubescent along veins, and have serrate margins. Flower heads are 15 to 45 and bear 8 to 15 disk florets in compound cymes, and corollas are yellow. Achenes are brownish black, straight or slightly curved, 12 to 20 millimeters (mm) (0.5 to 0.8 in) long, and 1 to 1.2 mm (0.04 to 0.05 in) wide (Ganders and Nagata 1999).

Taxonomy *Bidens conjuncta* was described by Sherff. This species is recognized as a distinct taxon in Ganders and Nagata (1999) and Wagner and Herbst (2003), the most recently accepted Hawaiian plant taxonomy.

Habitat *Bidens conjuncta* is found in *Metrosideros-Dicronopteris* lowland to montane wet forest and shrubland, in brown silty soil and leaf litter, on gentle to steep slopes in closed to open canopy, with the following associated species: *Antidesma* sp., *Broussaisia arguta*,

*Cheirodendron trigynum*, *Cibotium glaucum*, *Clermontia* spp., *Cyrtandra filipes*, *Diploterygium pinnatum*, *Dubautia* spp., *Hedyotis terminalis*, *Lycopodium cernuum*, *Melicope clusiifolia*, *Perrottetia sandwicensis*, *Phyllostegia ambigua*, *Plantago pachyphylla*, *Psychotria mariniana*, *Sadleria* sp., and *Urera glabra*, and elevations between 701 and 1,524 m (2,300 and 5,000 ft) (Ken Wood, National Tropical Botanical Garden, pers. comm. 1997; Hawaii Natural Heritage Program Database 2004).

Historical and Current Range/Current Status The species is restricted to the wet forests and bogs of west Maui. Seven populations are known, and the number of individuals totals at least 2,200 scattered throughout upper elevation drainages of Honolua, Kahakuloa, Honokohau, Waihee, Eke, Honokowai, and Kahoma valleys on west Maui (Wood and Perlman 1997; Hawaii Natural Heritage Program 2004; Steve Perlman, National Tropical Botanical Garden, pers. comm. 2000; Hank Oppenheimer, Maui Land and Pineapple Company, pers. comm. 2004 and 2005). Although the overall range of the species has not changed, the number of remaining individuals has declined over the last decade or so (Robert Hobdy, Hawaii Division of Forestry and Wildlife, pers. comm. 1995; S. Perlman and Ken Wood, pers. comms. 1996; Scott Meidel, Maui Land and Pineapple Company, pers. comm. 1996).

#### THREATS:

A. The present or threatened destruction, modification, or curtailment of its habitat or range. This species is threatened by feral pigs (*Sus scrofa*) that degrade or destroy habitat (Wood and Perlman 1997; R. Hobdy, pers. comm. 1995; Ken Wood and Scott Meidel, pers. comms. 1996). As early as 1778, European explorers introduced livestock, which became feral, increased in number and range, and caused significant changes to the natural environment of Hawaii. Past and present activities of introduced alien mammals are the primary factor altering and degrading vegetation and habitat on Maui. Pigs are currently present on Maui and four other islands, and inhabit rain forests and grasslands. While rooting in the ground in search of the invertebrates and plant material they eat, feral pigs disturb and destroy vegetative cover, trample plants and seedlings, and threaten forest regeneration by damaging seeds and seedlings. They disturb soil and cause erosion, especially on slopes. Alien plant seeds are dispersed on their hooves and coats as well as through their digestive tracts, and the disturbed soil is fertilized by their feces, helping these plants to establish. Pigs are a major vector in the spread of many introduced plant species (Smith 1985; Stone 1985; Medeiros *et al.* 1986; Scott *et al.* 1986; Tomich 1986; Cuddihy and Stone 1990; Wagner *et al.* 1999a). Pig exclusion fences protect about half of the known populations of this species; however, without continued monitoring and maintenance of those fences, pigs from surrounding areas can easily access fenced areas. In addition, the remaining, unfenced individuals of this taxon are still impacted by this threat.

B. Overutilization for commercial, recreational, scientific, or educational purposes.  
None known.

C. Disease or predation.

Because Hawaii's native plants evolved without any browsing or grazing mammals present, many lost natural defenses to such impacts (Carlquist 1980, Lamoureux 1994). Browsing by

ungulates has been observed on many other native species, including common and rare or endangered species (Cuddihy and Stone 1990; Loope *et al.* 1991). Therefore, even though there have been no observations of browsing for this species, it is likely that pigs impact this species directly as well as their indirect impacts to the surrounding habitat.

D. The inadequacy of existing regulatory mechanisms.

Pigs are managed in Hawaii as game animals but may populate inaccessible areas where hunting is difficult, if not impossible, and therefore has little effect on their numbers (Hawaii Heritage Program 1990). Pig hunting is allowed on all islands either year-round or during certain months, depending on the area (Hawaii Department of Land and Natural Resources n.d.-a, n.d.-b, n.d.-c). However, public hunting does not adequately control the number of pigs to eliminate this threat to *Bidens conjuncta*. Pig exclusion fences protect about half of the known populations of this species; however, without continued monitoring and maintenance of those fences, pigs from surrounding areas can easily access fenced areas. In addition, the remaining, unfenced individuals of this taxon are still impacted by this threat. Pig exclusion fences protect about half of the known populations of this species; however, without continued monitoring and maintenance of those fences, pigs from surrounding areas can easily access fenced areas. In addition, the remaining, unfenced individuals of this taxon are still impacted by this threat.

E. Other natural or manmade factors affecting its continued existence.

Alien plant species threaten this species (Wood and Perlman 1997; K. Wood, pers. comm. 1997). Although the exact pest species that threaten this plant have not been identified, alien pest plants are found throughout the areas where this species occurs. The original native flora of Hawaii consisted of about 1,400 species, nearly 90 percent of which were endemic. Of the total native and naturalized Hawaiian flora of 1,817 taxa, 47 percent were introduced from other parts of the world, and nearly 100 species have become pests (Smith 1985; Wagner *et al.* 1999a). Confirmed personal observations (K. Wood, pers. comm. 1997) and several studies (Cuddihy and Stone 1990; Wood and Perlman 1997; Robichaux *et al.* 1998) indicate nonnative plant species may outcompete native plants similar to *B. conjuncta*. Competition may be for space, light, water, or nutrients, or there may be a chemical inhibition of other plants (Smith 1985; Cuddihy and Stone 1990). In addition, nonnative pest plants found in habitat similar to that of this species have been shown to make the habitat less suitable for native species (Smathers and Gardner 1978; Smith 1985; Loope and Medeiros 1992; Medeiros *et al.* 1992; Ellshoff *et al.* 1995; Meyer and Florence 1996; Medeiros *et al.* 1997; Loope *et al.* 2004). In particular, alien pest plant species modify habitat by modifying availability of light, altering soil-water regimes, modifying nutrient cycling, or altering fire characteristics of native plant communities (Smith 1985; Cuddihy and Stone 1990; Vitousek *et al.* 1987). Because of demonstrated habitat modification and resource competition by nonnative plant species in habitat similar to the lowland wet forest and shrubland habitat of *B. conjuncta*, the Service believes nonnative plant species are a threat to *B. conjuncta*. Nonnative plants are being controlled in about half of the known populations of this species, but will probably never be completely eradicated because new propagules are constantly being dispersed into the fenced area from surrounding, unmanaged lands. Currently, many widespread alien plant taxa cannot be completely eradicated from Maui, and therefore are expected to continue dispersing into previously managed areas (Loope 1998, Smith 1985). The remaining unmanaged populations of *B. conjuncta* are still impacted by this threat.

## CONSERVATION MEASURES PLANNED OR IMPLEMENTED

The State of Hawaii and private landowners have initiated ungulate control and weed control in some of the areas where this species occurs. Construction of an ungulate exclosure fence in the Kahakuloa Game Management Area on Maui, funded through a Service grant to the State Division of Forestry and Wildlife, will protect individuals of *Bidens conjuncta* in this area (Maui Pineapple Company, Ltd. 1999). The fence construction began in August 2004 and is ongoing, so that no area is yet pig- or alien plant-free. In addition, the West Maui Watershed Partnership, a non-governmental, non-profit partnership composed of west Maui landowners and managers, received funding from the Service over the last five years for ungulate exclosure fences, which have been completed, and ungulate and nonnative plant control, which is ongoing. These actions provide protection to the individuals of *Bidens conjuncta* in the fenced areas in the west Maui mountains.

## SUMMARY OF THREATS:

The major threats to this taxon are pigs and nonnative plant species. Feral pigs have been fenced out of about half of the populations where *Bidens conjuncta* currently occurs, but the fences must be continually maintained to prevent incursion. Nonnative plants have been greatly reduced in the fenced areas. These on-going conservation efforts for this species benefit only about half of the known seven populations. The remaining populations are still impacted by these threats. Long-term monitoring and management will be required to maintain threat free areas.

## LISTING PRIORITY:

THREAT			
Magnitude	Immediacy	Taxonomy	Priority
High	Imminent	Monotypic genus	1
		Species	2
		Subspecies/population	3
	Non-imminent	Monotypic genus	4
		Species	5
		Subspecies/population	6
<b>Moderate to Low</b>	<b>Imminent</b>	Monotypic genus	7
		<b>Species</b>	<b>8*</b>
		Subspecies/population	9
	Non-imminent	Monotypic genus	10
		Species	11
		Subspecies/population	12

## Rationale for listing priority number:

*Magnitude:*

This species is moderately threatened by pigs that degrade and destroy habitat, and directly prey upon vegetative parts and fruit, and by nonnative plants that outcompete and displace it. Threats to lowland and montane wet forest and shrubland habitat of *Bidens conjuncta* and to individuals of this species occur throughout its range, and are expected to continue or increase without control or eradication. Feral pigs have been fenced out of about half of the populations of *Bidens conjuncta*, but the fences must be continually maintained to prevent incursion. Nonnative plants have been greatly reduced in the fenced areas. These on-going conservation efforts for this species benefit only about half of the known populations. The remaining populations are still impacted by these threats. Long-term monitoring and management will be required to maintain threat free areas.

*Imminence:*

Threats to *Bidens conjuncta* from pigs and nonnative plants are imminent because they are ongoing in half of the seven populations.

Yes Have you promptly reviewed all of the information received regarding the species for the purpose of determining whether emergency listing is needed?

Is Emergency Listing Warranted?

No. *Bidens conjuncta* is currently known from seven populations totaling 2,200 individuals. The species is threatened by feral pigs and by competition with nonnative plants. *Bidens conjuncta* does not appear to be appropriate for emergency listing at this time because the immediacy of the threats is not so great as to imperil a significant proportion of the taxon within the time frame of the routine listing process. In addition, the state and one private landowner currently manage the West Maui lands where this and other native species are found, for conservation. If it becomes apparent that the routine listing process is not sufficient to prevent large losses that may result in this species' extinction, then the emergency rule process for this species will be initiated. We will continue to monitor the status of *B. conjuncta* as new information becomes available. This review will determine if a change in status is warranted, including the need to make prompt use of emergency listing procedures.

DESCRIPTION OF MONITORING:

Much of the information in this form is based on the results of a meeting of 20 botanical experts held by the Center for Plant Conservation in December of 1995 and 1999, and was updated by personal communication with Robert Hobdy of Hawaii's Division of Forestry and Wildlife in 1995, Steve Perlman of National Tropical Botanical Garden in 1996 and 2000, Ken Wood of National Tropical Botanical Garden in 1996 and 1997, and Scott Meidel, Maui Land and Pineapple Company in 1996. We have incorporated additional information on this species from our files and the most recent supplement to the *Manual of the Flowering Plants of Hawaii* (Wagner and Herbst 2003). In 2004, the Pacific Islands office contacted the following species experts: Bob Hobdy, retired from Hawaii Division of Forestry and Wildlife; Joel Lau, Hawaii Natural Heritage Program; Art Medeiros, U.S.G.S. Biological Resources Discipline; Hank Oppenheimer, resource manager for Maui Land and Pineapple Company; and Steve Perlman and Ken Wood, National Tropical Botanical Garden. New information on the status of the species was provided by Hank Oppenheimer in 2004. In 2005 we contacted the species experts listed

below and confirmation of the status of *Bidens conjuncta* was provided by Hank Oppenheimer of Maui Land and Pineapple Company.

The Hawaii Natural Heritage Program identified this species as critically imperiled (Hawaii Natural Heritage Program Database 2004). Based on the International Union for Conservation of Nature and Natural Resources Red Plant Data Book rarity categories, this species is recognized as Rare (could be considered at risk) by Wagner *et al.* (1999b).

One species expert provided new information confirming the status of the species this year and the results are included in this assessment.

#### COORDINATION WITH STATES:

In October 2004 we provided the Hawaii Division of Forestry and Wildlife with copies of our most recent candidate assessments for their review and comment. Vickie Caraway, the State botanist, reviewed the information for *Bidens conjuncta* and suggested that this species may meet the interim recovery objectives for Hawaiian plants, and therefore may not warrant listing (V. Caraway, pers. comm. 2005). The interim recovery objectives for a short-lived species such as this taxon are aimed at stabilizing the species and preventing extinction in the near future, and include 1) the existence of 3 populations of 50 reproducing individuals each, 2) all threats managed and, 3) the species in genetic storage. While the populations numbers may meet the interim recovery objectives and half of the populations have been fenced with ongoing weed control in the fenced areas, the threats are not controlled in the other, unfenced populations. In addition, this species is not in genetic storage. Therefore, the interim objectives have not been met for *B. conjuncta*, and we believe listing is warranted for *B. conjuncta*.

#### LITERATURE CITED and REFERENCES:

##### List all experts contacted:

Name	Date	Place of Employment
1. Joel Lau	June 28, 2005	Hawaii Natural Heritage Program
2. Art Medeiros	June 28, 2005	U.S.G.S. Biological Resources Discipline
3. Jim Jacobi	June 28, 2005	U.S.G.S. Biological Resources Discipline
4. Rick Warshauer	June 28, 2005	U.S.G.S. Biological Resources Discipline
5. Hank Oppenheimer*	June 28, 2005	Maui Land and Pineapple Company
6. Kapua Kawelo	June 28, 2005	U.S. Army
7. Dave Lorence	June 28, 2005	National Tropical Botanical Garden
8. Steve Perlman	June 28, 2005	National Tropical Botanical Garden
9. Ken Wood	June 28, 2005	National Tropical Botanical Garden
10. Marie Brueggmann	July 13, 2005	U.S. Fish and Wildlife Service
11. Vickie Caraway	June 14, 2005	Hawaii Division of Forestry and Wildlife

\*Provided new information on this taxon in 2005

##### List all databases searched:

Name	Date
1. Hawaii Natural Heritage Program	2004

Other resources utilized:

- Carlquist, S. 1980. Hawaii: A natural history, 2nd edition. Pacific Tropical Botanical Garden, Honolulu. 468 pp.
- Center for Biological Diversity, Dr. Jane Goodall, Dr. E.O. Wilson, Dr. Paul Ehrlich, Dr. John Terborgh, Dr. Niles Eldridge, Dr. Thomas Eisner, Dr. Robert Hass, Barbara Kingsolver, Charles Bowden, Martin Sheen, the Xerces Society, and the Biodiversity Conservation Alliance. 2004. Hawaiian Plants: petitions to list as federally endangered species. May 4, 2004.
- Cuddihy, L.W., and C.P. Stone. 1990. Alteration of native Hawaiian vegetation; effects of humans, their activities and introductions. Coop. Natl. Park Resources Stud. Unit, Hawaii. 138 pp.
- Ellshoff, Z.E., D.E. Gardner, C. Wikler, and C.W. Smith. 1995. Annotated bibliography of the genus *Psidium*, with emphasis on *P. cattleianum* (strawberry guava) and *P. guajava* (common guava), forest weeds in Hawai'i. Cooperative National Park Resources Studies Unit, University of Hawaii. Technical Report 95.
- Ganders, F.R. and K.M. Nagata. 1999. *Bidens*: In Wagner, W.L., D.R. Herbst, and S.H. Sohmer, Manual of the Flowering Plants of Hawai'i. University of Hawaii Press and Bishop Museum Press, Honolulu. Bishop Mus. Spec. Publ. 97: 267-283.
- Hawaii, Department of Land and Natural Resources. N.d.-a. Summary of Title 13, Chapter 123, Game mammal hunting rules, island of Oahu. Division of Forestry and Wildlife, Honolulu. 2 pp.
- Hawaii, Department of Land and Natural Resources. N.d.-b. Summary of Title 13, Chapter 123, Game mammal hunting rules, island of Molokai. Division of Forestry and Wildlife, Honolulu. 2 pp.
- Hawaii, Department of Land and Natural Resources. N.d.-c. Summary of Title 13, Chapter 123, Game mammal hunting rules, island of Maui. Division of Forestry and Wildlife, Honolulu. 2 pp.
- Lamoureux, C.H. 1994. Conserving Hawaiian biodiversity – the role of Hawaiian botanical gardens. Pp. 55-57. In: C.-I Peng and C.H. Chou (eds.). Biodiversity and Terrestrial Ecosystems. Institute of Botany, Academia Sinica Monograph Series No. 14.
- Loope, L.L., A.C. Medeiros, and B.H. Gagné. 1991. Recovery of Vegetation of a montane bog following protection from feral pig rooting. Coop. Natl. Park Resources Studies Unit, Univ. Hawaii/Manoa, Dept. Of Botany, Tech. Rept. 77.
- Loope, L.L. and A.C. Medeiros. 1992. A new and invasive grass on Maui. Newsletter of the Hawaiian Botanical Society 31: 7-8.
- Loope, L.L. 1998. Hawaii and Pacific Islands. Pp. 747-774. In: M.J. Mac, P.A. Opler, C.E. Puckett Haecker, and P.D. Doran (eds.). Status and Trends of the Nation's Biological Resources, Volume 2. U.S. Department of the Interior, U.S. Geological Survey, Reston, VA.
- Loope, L., F. Starr and K. Starr. 2004. Management and research for protecting endangered Hawaiian plant species from displacement by invasive plants on Maui, Hawaii. Weed Technology 18: 1472-1474.
- Maui Pineapple Company, Ltd. 1999. Pu'u Kukui Watershed Management Area, Kahalawai, Maui, Hawai'i, Fiscal Year 1999 Progress Report, Biannual Report. Submitted to the



- State of Hawai'i Department of Land and Natural Resources Natural Area Partnership Program, January, 1999.
- Medeiros, A.C., Jr., L.L. Loope, and R.A. Holt. 1986. Status of native flowering plant species on the south slope of Haleakala, East Maui, Hawaii. Coop. Natl. Park Resources Stud. Unit, Hawaii, Techn. Rept. 59:1-230.
- Medeiros, A.C., L.L. Loope, P. Conant and S. McElvaney. 1997. Status, ecology, and management of the invasive plant, *Miconia calvenscens* DC (Melastomataceae) in the Hawaiian Islands. Bishop Mus. Occas. Pap. 48: 23-36.
- Medeiros, A.C., L.L. Loope, T. Flynn, S.J. Anderson, L.W. Cuddihy, and K.A. Wilson. 1992. Notes on the status of an invasive Australian tree fern (*Cyathea cooperi*) in Hawaiian rain forests. American Fern Journal 82: 27-33.
- Meyer, J.-Y. and J. Florence. 1996. Tahiti's native flora endangered by the invasion of *Miconia calvenscens* D.C. (Melastomataceae). Journal of Biogeography 23: 775-781.
- Robichaux, R., J. Canfield, F. R. Warshauer, L. Perry, M. Brueggemann, and G. Carr. 1998. Adaptive Radiation. Endangered Species Bulletin. November/December.
- Scott, J.M., S. Mountainspring, F.L. Ramsey, and C.B. Kepler. 1986. Forest bird communities of the Hawaiian Islands: Their dynamics, ecology, and conservation. Studies in Avian Biology 9:1-429. Cooper Ornithological Society, Los Angeles.
- Smathers, G.A. and D.E. Gardner. 1978. Stand analysis of an invading firetree (*Myrica faya* Aiton) population, Hawai'i. Proceeding of the Second Conference on Natural Science, Hawaii Volcanoes National Park, pp. 274-288.
- Smith, C.W. 1985. Impact of alien plants on Hawai'i's native biota: in Stone, C.P., and J.M. Scott (eds.), Hawai'i's Terrestrial Ecosystems: Preservation and Management. Coop. Natl. Park Resources Stud. Unit, Univ. Hawaii, Honolulu, pp. 180-250.
- Stone, C.P. 1985. Alien animals in Hawai'i's native ecosystems: toward controlling the adverse effects of introduced vertebrates: *In* Stone, C.P., and J.M. Scott (eds.), Hawai'i's Terrestrial Ecosystems: Preservation and Management. Coop. Natl. Park Resources Stud. Unit, Univ. Hawaii, Honolulu, pp. 251-297.
- Tomich, P.Q. 1986. Mammals in Hawai'i: A synopsis and notational bibliography. Bishop Museum Press, Honolulu. 375 pp.
- Vitousek, P.M., C.M. D'Antonio, L.L. Loope, M. Rejnaneck, and R. Westerbrooks. 1997. Introduced species: a significant component of human-caused global change. New Zealand Journal of Ecology 21(1): 1-16.
- Wagner, W.L., D.R. Herbst, and S.H. Sohmer. 1999a. Manual of the Flowering Plants of Hawai'i. Bishop Mus. Spec. Publ. 97: 1-1918. University of Hawaii Press and Bishop Museum Press, Honolulu.
- Wagner, W.L., M.M. Brueggemann, and J.Q.C. Lau. 1999b. Hawaiian vascular plants at risk: 1999. Bishop Mus. Occas. Pap. 60: 1-58.
- Wagner, W.L. and D.R. Herbst. 2003. Electronic supplement to the manual of flowering plants of Hawai'i, version 3.1. December 12, 2003. Available from the Internet. URL: <http://rathbun.si.edu/botany/pacificislandbiodiversity/hawaiianflora/supplement.htm>.
- Wenham, R. 1969. Kauai and the Park Country of Hawaii. Sierra Club, San Francisco. 160 pp.
- Wood, K.R. and S. Perlman. 1997. Maui 14 plant survey final report. Submitted by National Tropical Botanical Garden, October, 1997.



APPROVAL/CONCURRENCE: Lead Regions must obtain written concurrence from all other Regions within the range of the species before recommending changes to the candidate list, including listing priority changes; the Regional Director must approve all such recommendations. The Director must concur on all 12-month petition findings, additions of species to the candidate list, removal of candidate species, and listing priority changes.

Approve: **Acting** David W. Winkler 11/10/05  
Regional Director, Fish and Wildlife Service Date

Marshall P. Jones

Concur: 8/23/2006  
Director, Fish and Wildlife Service Date

Do not concur: \_\_\_\_\_  
Director, Fish and Wildlife Service Date

Date of annual review: September 21, 2005  
Conducted by: Marie M. Bruegmann, Pacific Islands FWO  
Plant Recovery Coordinator

Comments:  
PIFWO Review

Reviewed by: Christa Russell Date: September 22, 2005  
Plant Conservation Program Leader

Gina Shultz Date: October 14, 2005  
Assistant Field Supervisor,  
Endangered Species

Patrick Leonard Date: October 14, 2005  
Field Supervisor